LAWRENCE LIVERMORE
REPORT

A weekly review of scientific and technological achievements from Lawrence Livermore National Laboratory, April 18-22, 2011

Save the brain

LLNL mechanical engineer Mike King (left) and physicist Willy Moss watch a compression test of a helmet pad.

Soldiers using military helmets one size larger and with thicker pads could reduce the severity of traumatic brain injury (TBI) from blunt and ballistic impacts.

LLNL researchers realized this after a one-year study funded by the U.S. Army and the Joint IED Defeat Organization (JIEDDO) to compare the effectiveness of various military and football helmet pads in mitigating the severity of impacts.

The findings have been presented to the Program Executive Office (PEO) Soldier, the U.S. Army acquisition agency responsible for everything a soldier wears or carries.

In 2009, Gen. Peter Chiarelli, of the Vice Chief of Staff of the Army, directed JIEDDO to review the mitigation capabilities of the U.S. Army's Advanced Combat Helmet (ACH) against impact injuries. LLNL researchers Willy Moss and Mike King were tasked to determine if the pads used by the NFL might protect against militarily relevant impacts better than the pads currently used in the ACH.

To read more, go to the Web.

It sniffs out rogues

An elusive neutral particle known as an antineutrino could help international inspectors peer inside working nuclear reactors to determine if excess fuel is being used for something other than operating the reactor.

Nuclear reactors supply the planet with much of its electricity, but the uranium and plutonium that serve as their fuel can be diverted from reactors for use in weapons.

Livermore researchers are investigating devices known as antineutrino detectors as a continuous, real-time and less intrusive technique than prior safeguard systems. The International Atomic Energy Agency has started to consider the potential of these detectors to keep tabs on reactors by flagging excess plutonium and uranium being used beyond what its operators declare it is making.

The detector could be placed by safeguard agencies on the reactor site a few dozen yards away from the reactor core.

Antineutrinos interact with other matter only through gravitational and weak forces, which makes them very difficult to detect. However, the number of antineutrinos emitted by nuclear reactors is so large that a cubic-meter scale detector suffices to record them by the hundreds or thousands per day. This new detector makes practical monitoring devices for nonproliferation applications possible.

To read more, go to the Web.

Diving deep into the Earth

A snapshot taken from a first-principles molecular dynamics simulation of liquid methane in contact with a hydrogen-terminated diamond surface at high temperature and pressure.

Animal remains buried long ago may not be the only source of fuel.

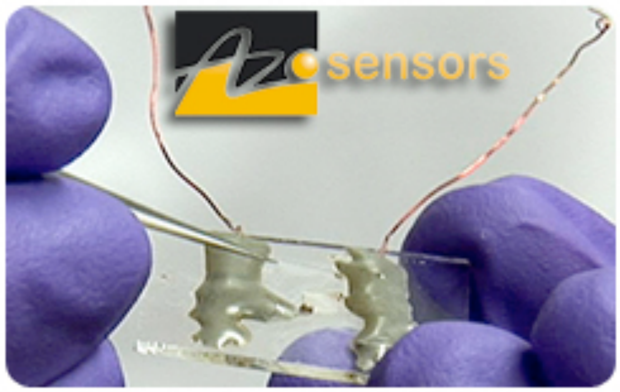
New Laboratory research shows that high hydrocarbons also could be formed from methane deep within the Earth.

LLNL scientists used supercomputers to simulate what would happen to carbon and hydrogen atoms buried 40 to 95 miles beneath the Earth's crust, where they would be subjected to extreme pressures and temperatures.

They found at temperatures greater than 2,240 degrees Fahrenheit and pressures 50,000 times greater than those at the Earth's surface, methane molecules can fuse to form hydrocarbons with multiple carbon atoms.

To read more, go to the Web.

No batteries required



The sensor part of the device is about 2 millimeters in size.

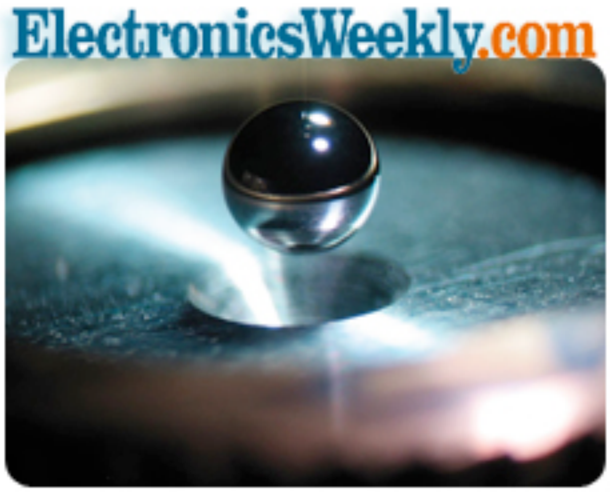
Laboratory scientists have developed a battery-less chemical detector that uses one-dimensional semiconductor nanowires.

The nanosensor device does not rely on traditional batteries. It is simple and has the capability to quickly detect different molecules. The interaction that takes place between the semiconductor nanowire surfaces and the chemical species creates an electrical charge between unexposed and exposed nanowires.

The nanosensor was tested more than 15 types of solvents, including ethanol and hexane, on silicon and zinc-oxide platforms. Experiments showed that the nanosensors would be able to distinguish various types of chemical species as well as their concentration levels.

To read more, go to the Web.

A picture is worth a thousand words



A NIF target contains a polished capsule about two millimeters in diameter, filled with cryogenic (super-cooled) hydrogen fuel.

Electronic Weekly recently posted a pictorial look at the National Ignition Campaign (NIC), a series of experiments and simulations for fusion ignition tests, using lasers that have broken the megajoule barrier

The National Ignition Facility at Lawrence Livermore is the world's largest and most energetic laser. NIC is a series of test shots to fine tune the performance of NIF's lasers, calibrate its diagnostic equipment, and verify the sophisticated computer simulations that help to guide the design of NIF's fusion targets.

NIF researchers hope to achieve fusion next year.

To see the pictorial, go to the Web.
